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Cold Condition Influence on the Pulmonary Function in Smoking Military Men

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Summary

Aim: Revealing of latent injuries of airways in smoking military men with age of 18-40 year, who serves from time to time under extreme climatic condition (cold, dry, windy weather on moderate altitude);

Materials and Methods: It was investigated 54 smoker militaries (males, 18-40 years old). The investigation was carried out during 1 year on the permanent place of location of armed unit and on the place of field mission in winter (moderate altitude of Caucasus). It was performed questioning of smoking index and tobacco-dependence. It was investigated respiratory function of lungs, routine hemodynamic and red blood indices. In control group were included healthy nonsmoker militaries from the same military unit.

Results: the investigation showed that in smokers (as heavies as middles) respiratory function tests (FEF₂₅, FEF₅₀, FEF₇₅) decreased significantly after influence of cold, dry mountain air. It means that the pathological process has already begun in small airways.

Conclusions: Smoking is one of most aggressive risk factors of Respiratory Diseases. The usual loading of soldiers: moderate physical activity under the extreme climatic conditions (cold, windy air of moderate altitude), may be the provocative testes for lung diseases in the so-called "healthy smokers". The level of change of Respiratory Functional Testes in smokers mainly depends on smoking index, hereditary abundance, predisposition to allergy and constitutional qualities.

Key Words: tobacco, smoking, small airways, moderate altitude, and cold air.

Introduction

The relationship between human organism and an environment is determined by nature as harmonic. Homo Sapiens, by means of his mental abilities, always - during the evolutionary process, created a lot of problems of adaptation to his environment and tried at the same time to improve them.

Many risk factors, such as: industrial pollution, radiation, tobacco, alcohol etc. are the products of civilization and they cause various diseases or induce their manifestation. The essence of disease is a disbalance between the human organism and an environment. "What is an illness, if not Freedom Restricted Illness" - wrote Marx. But the freedom of health is human organisms' capacity to adapt to

stressful environmental factors, to defend himself and to auto regulate. It is difficult to divide strongly health and illness. We can only try to expose beginning of the pathological process in concrete person. Just this is a main idea of our work, the fragment of which I would like to present you. It includes an investigation of adaptive process among soldiers of Georgian Army, exposure of risk groups of various diseases, and tries to improving their military life and service standards.

In the Georgian Army there are many problems and one of them is smoking. According to previous investigation carried out with help of the special "Smokers Questionnaire"(2, 4), it was shown that 76% of Georgian military personnel are smokers, but among soldiers this index reaches 85%.

It is known that smoking, as an aggressive risk factor, causes and supports the progress of numerous diseases. In spite of this, for most people it is very difficult smoking cessation. In cigarettes there are about 2000-4000 different harmful products; among which the most harmful are: Nicotine, Irritants (acrolein, aldehyds, soot etc.), Carcinogens etc.

Smoking injures the whole organism, mainly Cardiovascular (CS) and Respiratory systems (RS). The Chronicle Obstructive Pulmonary Diseases (COPD) are mostly widespread diseases of RS caused by tobacco, developed among 15-20% of smokers. It is known that much before the manifestation of bronchoobstructive syndrome, reversible and than irreversible process begins in small airways (below 2-mm diameter), which are responsible for total pulmonary resistance in 20% and in 99% they are the components of total airways-volume. Early revealing of these pathological changes is very important for prevention and treatment of COPD and other chronicle lung diseases.

Extreme environmental factors, such as: cold windy weather, industrial pollution, physical exercise etc. often cause the latent respiratory pathology. In our work we have used as such extreme factors: natural winter cold dry air of the Caucasian moderate altitude and moderate physical exercise in these conditions. With help of them we tried to exposure the airway pathology among smoker individuals, which are regarded as healthy, because by routine medical examination in normal conditions didn't is founded any pathology.

Materials and Methods

54 military persons are investigated: smokers military men from the Unit of Georgian Terrestrial Armed Forces, which is located near Tbilisi, in borough *Kojori* (higher from sea level - 1350m; middle annual temperature: 7,4°C; middle winter temperature: -2,6°C; climate: demp subtropical. The service of these militaries includes the short missions to different regions of Georgia. Among them are the regions of moderate altitude of Caucasus: Kazbegi, Svaneti, Thousheti, Javaxeti (there are not included the summits of these regions). Their common middle characteristic: higher from the sea level: 2000-3200m; climate: cold continental; middle annual temperature: -1,2°C; middle winter Temperature: -15,2°C, often windy (speed: 15-20m/sec). The field missions had been performed by the small groups (6 persons). Each of them performs this mission twice per cold season. During this mission they have some moderate physical activity (climbing, walking etc). The control group included 25 healthy nonsmoker men from the same unit.

Smoking index and *tobacco-dependence* were evaluated by special questionnaires: K. O. Fagerstorm's, 54-item smoker's questionnaire, smoking index formulae (2, 4). Beside this they have been questioned with purpose to establish other risk factors, as a hereditary abundance, allergy and frequent airways acute inflammatory diseases in anamnesis and have been made routine clinical examination.

During observation were used such Respiratory Functional Tests:

- Lung Vital Capacity (LVC)
- Forced Vital Capacity (FVC)
(It was investigated on the Spirograph)
- Forced expiration Volume in 1st second (FEV1)
Forced Expiratory Flow between 25, 50 and 75 % of FVC (FEF₂₅, FEF₅₀, FEF₇₅) (Fig. 1)

(It was investigated on the portative Flowscreen "Jeger")

The blood oxygen saturation was been determined on the portative "Pulsoximeter 540".

Dynamic study of hemodynamic (HR, T/A) and red blood indices (Hb, Er, Fi, Ht) was also performed.

These investigations were performed by stages:

- At the place of permanent location of the Military Unit- Kojori, in moderate climatic condition: in September;
- At the place of field mission: on the moderate altitude, in winter, twice, immediately after exercise (ascent and descend of $\approx 500-700\text{m}$ of terrestrial level).
- At the place of permanent location- in Kojori, immediately on return from the mission.
- One year later after beginning of our observation.

Results and Discussion

According the previous investigation: questioning, routine clinical examination, - we have determined two main subgroups:

1. "Healthy Smokers" -- among which we could not find any pathology: 37 persons (68,5%).
2. "The group of Prebronchitis"-- persons, who have not had complaints but they sometimes had matutinal cough and offensive nonproductive or productive cough caused by some factors: inhalation of cold air, cold drink, hard physical exercise, emotional stress etc.; and have in anamnesis (during last 2 year) 3-4 times and over acute airway inflammatory diseases: 17 persons (31,5%).

19 persons (36%) from both subgroups had initially decreased FEF₅₀ and FEF₇₅ (authentic, $p < 0,005$).

According data of Fagerstorm's 6-item questionnaire of tobacco-dependence, it was determined three groups:

1. Light tobacco-dependence, - in 25 persons (46,5%);
2. Middle tobacco-dependence, - in 20 persons (37,8%);
3. Heavy tobacco-dependence, - in 9 persons (16,7%)

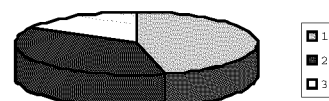


Fig 2

Two groups were determined by smoking index (I):

1. Middle smokers -42 person (77%)
2. Heavy smokers - 12 persons (23%)

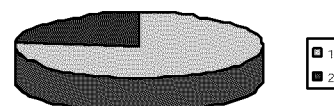


Fig 3

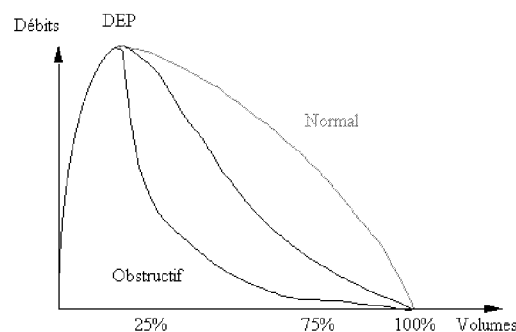


Figure 1

The investigation of respiratory functions at moderate altitude, cold windy weather, under physical activity, showed that in the 1st subgroup FEF₅₀₋₇₅ was decreased in 36 % ($p < 0,01$); and FEV1 was decreased in 18%, but not authentically ($p < 0,1$). FEV1/FVC remained on normal level - 70-75%.

Table 1

Index	Permanent place - Kojori Oct. (alt_ 1350m, middle t°_15°C) %	Permanent place - Kojori Jan. (alt_ 1350m, middle t°_ -2,3°C) %	Mission place - January (alt-2700, middle t°_-16°C) %	Permanent place - Kojori, 1 year later, Oct (alt_ 1350m, middle t°_15°C) %
VC	104.12 ± 1.82	98.78 ± 1.01	96.72 ± 1.4	103.25 ± 1.2
FEV1	102.70 ± 1.86	98.67 ± 1.01	89.37 ± 1.9	96.22 ± 1.8
FEV1/FVC	72.17 ± 0.67	70.23 ± 0.69	68.83 ± 0.97	73.86 ± 1.54
FEF ₇₅	99.05 ± 0.81	97.85 ± 1.04	82.21 ± 1.82	83.14 ± 1.6 *
FEF ₅₀	102.65 ± 1.72	96.86 ± 1.01	79.25 ± 1.71 *	79.25 ± 1.4 *
FEF ₂₅	99.56 ± 1.75	97.79 ± 0.97	86.79 ± 1.9	89.12 ± 1.8

(* - Authentic data)

In the second subgroup (group of "Prebronchitis") decrease of FEF₂₅₋₇₅ was authentic in 67% - 12 persons ($p < 0,005$). Decrease of FEV1 and FEV1/FVC was authentic in 33% of 2nd subgroup ($p < 0,01$).

Table 2

Index	Permanent place - Kojori Oct. (alt_ 1350m, middle t°_15°C) %	Permanent place - Kojori Jan. (alt_ 1350m, middle t°_ -2,3°C) %	Mission place - January (alt-2700, middle t°_-16°C) %	Permanent place - Kojori, 1 year later, Oct (alt_ 1350m, middle t°_15°C) %
VC	101.18 ± 1.62	99.73 ± 1.01	95.72 ± 1.40	98.25 ± 1.68
FEV1	97.76 ± 1.86	94.67 ± 1.01	86.37 ± 1.92	81.22 ± 1.80*
FEV1/FVC	72.17 ± 0.67	70.23 ± 0.69	68.83 ± 0.97	67.86 ± 1.54
FEF ₇₅	89.05 ± 0.81	92.85 ± 1.04	76.21 ± 1.82 *	79.14 ± 1.60*
FEF ₅₀	85.65 ± 1.72	96.86 ± 1.01	72.25 ± 1.71 *	77.76 ± 1.42*
FEF ₂₅	95.56 ± 1.75	92.79 ± 0.97	76.79 ± 1.90	71.12 ± 1.89*

During field missions a few soldiers had some clinical manifestation of bronchitis: one had an attack of bronchospasm, which was suppressed immediately after salmeterole inhalation. 8 persons from both groups had an episode of offensive nonproductive cough (by lung auscultation: expiratory dry wheeze). 5 persons got pharyngitis.

These changes showed that cold and dry air serves as a provocative test for middle and heavy smokers and latent bronchoobstructive syndrome was manifested.

The investigation, made immediately on their arrival in Kojori, showed that FEV1, FEV1/FVC improved in couple of days, but the change of FEF₂₅₋₇₅ partially remained during 7-10 days.

Repetitive investigation, made 1 year later from the beginning our work, showed that in 12 persons from both subgroups (particularly from 2nd - 9 persons FEF₂₅₋₇₅ was authentically decreased ($p < 0,005$), compared with initial data. But the changes of other tests were not authentic.

Hemodynamic data and changes of HR and T/A during this observation period were adequate, quite normal. Blood oxygen saturation also was normal and adequate during this period.

In control group all data were normal (except 4 cases when soldiers got acute respiratory viral infection and have been removal from investigation).

It is notable that

1. Some persons from second group cessated smoking. By last investigation it was shown that their respiratory indices are not decreased.
2. In 25% of both subgroups the LVC and FVC increased. We think that it was caused by physical activity on mountain fresh air.

The blood oxygen saturation, HR, T/A, red blood indices (Hb, Ht, Fi, Er) remained on the normal level and has changed adequately according constitutional and age norms. It means that lung alveolar respiratory function had been normal yet.

According to our investigation data, it is clear that smoking damages small airways quite early (decrease of FEF₂₅₋₇₅) and not only among heavy smokers.

Among those who clinically developed bronchoobstructive syndrome were mainly heavy smokers, with heavy tobacco-dependence, and persons with hereditary and anamnestic abundance.

Conclusions:

1. Smoking is one of most aggressive risk factors of Respiratory Diseases. Particularly for Chronic Obstructive Pulmonary Diseases (COPD);
2. The usual loading of soldiers: moderate physical activity under the extreme climatic conditions (cold, windy air of moderate altitude), may be the provocative testes for lung diseases in the so-called "healthy smokers".
3. The level of change of Respiratory Functional Testes in smokers mainly depends on smoking index, hereditary abundance, predisposition to allergy and constitutional qualities.
4. Among smokers the damage of small airways develops quite early and after some times this becomes irreversible. Determination of this time is very difficult. Therefore it is very important to early smoking cessation, to devise especial individual exercise and diet regimen for the rehabilitation of former smokers.

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